Strategy Research Project

BREAKING THE INERTIA: MOVING BEYOND AMERICA'S ADDICTION TO FOREIGN OIL

BY

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BREAKING THE INERTIA: MOVING BEYOND AMERICA'S ADDICTION TO FOREIGN OIL

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ABSTRACT

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The United States predominately relies upon a single source of energy, petroleum, to meet the growing energy demands of the nation and has done so for more than one hundred years. To overcome this major impediment, this paper proposes utilizing the military element of national power as a primary implementer of responsible energy efficiency practices and a developer of alternate, sustainable sources of energy to help the nation validate methods for overcoming its foreign-sourced energy dependency. This paper utilizes the framework of ends, means, ways and risk to articulate a Department of Defense enabled solution to the nation's oil addiction. Use of the Department of Defense seems like a natural course of action, since the military's energy demands represent a microcosm of the United States' energy demands and it routinely develops innovative technical solutions to strengthen the nation's defense posture.

BREAKING THE INERTIA: MOVING BEYOND AMERICA'S ADDICTION TO FOREIGN OIL

> It will be remarkable if we reach the end of this century without the preeminence of oil being tested or challenged yet again…[1]
>
> —Daniel Yergin

The United States predominately relies upon a single source of energy, petroleum, to meet the growing energy demands of the nation and has done so for more than one hundred years. Historically, independent oil companies within the United States and other western nations played a key role in the development of oil resources. The United States' principal role in the development of oil resources ensured affordable and available supplies to meet its energy demands. Over time, the availability of oil, especially foreign oil, allowed the nation to develop a dependency best described today as an "addiction."[2]

Since the 1970's the political leadership of the United States recognized the inherent risks associated with its "addiction" to foreign oil. To reduce risk to both foreign and domestic interests of the United States every President since Richard Nixon called for reducing U.S. dependency on foreign oil imports. All have rightfully connected this issue directly to maintaining the national security interests of the United States. In addition, U.S. history reflects the risk of being "dependent" upon another nation or a small number of nations for one its primary energy sources. Many Americans still remember the economic disruptions and social chaos created by the Middle East Oil Embargo of 1973 and 1974. In spite of historical precedence and Presidential efforts to lead American society away from this danger, the nation's addiction and associated national security risk continues to grow. Failure to control this growing addiction by the

nation's leadership creates a tenuous situation best articulated by CNA's Military Advisory Board, "Americas approach to energy has placed the nation in a dangerous and untenable position."[3] Overcoming this dangerous situation requires the nation to develop programs to reduce energy consumption and transition to alternate, preferably renewable, sources of energy. Acceptance of risk plays a key role in this these programs as well. Nearly every option for achieving true energy efficiency or the adoption of alternate energy resources comes with a significant capital investment cost. Very few elements of the private sector or public municipalities can absorb this level of investment risk. To overcome this major impediment, this paper proposes utilizing the military element of national power as a primary implementer of responsible energy efficiency practices and a developer of alternate, sustainable sources of energy to help the nation validate methods for overcoming its foreign-sourced energy dependency.

Addressing the nation's oil addiction must be preceded by reviewing the historical context of the problem. Embedded within this discussion is the concept of risk as it relates to economic volatility, supply vulnerability, and its implications on United States National Security. Subsequently, this paper will utilize the framework of ends, means, ways and risk to articulate a Department of Defense enabled solution to the nation's oil addiction. Use of the Department of Defense seems like a natural course of action, since the military's energy demands represent a microcosm of the United States' energy demands and it routinely develops innovative technical solutions to strengthen the nation's defense posture.

The Growth of "Addiction"

Following World War II, increased demand for energy by the United States resulted in the establishment of numerous international oil companies that provided

cradle to grave energy to meet these demands. Through the commercial development of extensive resources and infrastructure in the Middle East, Mexico, and South America, these international oil companies produced affordable oil supplies to meet the growing energy demands of the nation. As stated by Verrastro et al in their work concerning the global oil markets, “Over the past 50 years, as both a major energy producer and the world’s largest consumer, the United States has played an extremely influential (almost authoritative) role in advancing the basic ground rules for global energy markets.”[4] Thus began the oil “addiction” of the United States.

This physical control over the global development of oil resources provided cheap and plentiful supplies of oil that allowed the United States to develop and implement economic trade agreements and foreign policies based upon a single energy source. The nation consolidated its energy source in this manner for two primary reasons. First, oil provides the most efficient fuel source due to its chemical properties and secondly, a singular source of energy provides the ability to capitalize upon commonality. An example of this commonality is the almost singular use of oil within the U.S. transportation system. According to the CNA’s Military Advisory Board, “…oil provides 96 percent of the energy to power the U.S.’s transportation sector…”[5] Similar to the nation, the Department of Defense developed equipment, doctrine, and unfortunately a culture based upon oil as its predominant energy source. Although America’s current addiction to foreign oil developed based upon abundant and affordable oil supplies, the global energy market changed dramatically over time.

Current Global Market Risk

This changing market increased risk as defined by economic volatility, supply vulnerability, and overall security to the United States. The nation recognized this

changing market but failed to appropriately adjust domestic and foreign policies to mitigate the risk associated to these changes. Instead of defining a national strategic "end" or goal that reduces foreign imports, intensifying demand by the United States precipitated one of the most significant changes in the global oil market. As the oil rich nations recognized the growing U.S. dependency on foreign oil imports, they initiated the development of state owned companies, the nationalization of oil producing infrastructure, and economic measures to seize wealth and power. Richard B. Andres highlights this extensive shift and surmises that almost ninety percent of petroleum reserves currently fall under national control or the exports flow through nationally owned companies.[6] These actions empower a select group of nations to exert various national interests onto the global oil market in the form of "Petro-Politics."[7]

Promoting national interests through this increased control of oil resources produces significant impacts on oil dependent nations. In their article regarding "Petro-Politics", Flynnt Leverett and Pierre Noel describe, "The increasing control that state-owned companies exercise over the world's reserves of crude oil and natural gas is…enabling some energy exporters to act with escalating boldness against U.S. interests and policies."[8] Common examples of challenges to U.S. economic interests and foreign policies are numerous. Saudi Arabia, Mexico, Iraq, Venezuela and others within the top fifteen suppliers of oil to the United States often challenge U.S. national interests, either directly or indirectly, through their economic and foreign policies.[9] In turn, this significant shift in the application of resource-based power produces dramatic effects on the diplomatic and economic policies of the United States. Summarized by Thomas Kraemer's discussion of this issue, "America is hamstrung because any

forceful action on our part … could result in the disruption of oil supplies that the world economy completely depends upon."[10] Additionally, the global nature of these issues creates increased pressures on the United States' ability to maintain positive foreign relations with other oil dependent nations which further complicates the development of solutions to the nation's addiction.

Due to the intertwined nature of economic volatility and supply vulnerability the risk associated with these factors is difficult to separate. However, the United States' insatiable appetite for oil exacerbates both of these factors and when combined with the physical security challenges promote increased frictions within the global oil market. Richard G Lugar quantifies the United States demand for oil, "With less than 5 percent of the world's population, the United States consumes 25 percent of the world's supply of oil."[11] In terms of sheer volume, this equated to approximately 12.9 million barrels per day in 2008 of crude oil and refined petroleum products.[12] This quantity roughly equates to the amount of oil imported per day by Japan, China, and Germany combined.[13] As other developing nations increase their demands within the global market, competition increases amongst all consumers. The challenge for U.S. policy makers is maintaining critical but tenuous relationships with oil suppliers as described by Verrastro et al, "…actions of these countries, relationships among countries, and relationships among countries and companies all become more important."[14]

To support its addiction, the United States continues to accept risk in the form of economic volatility from an imperfect global oil market at enormous cost. A July 2010 CNA study quantified the monetary cost of imported oil to the nation as $386 billion dollars in 2008 and over $350 billion dollars in 2009. These expenditures were in spite

of financial stressors associated with an economic recession.[15] Economic volatility also creates a budgetary challenge for the Department of Defense as it strives to effectively execute its mission of defending the nation. The cost of energy for the Department of Defense is approximately $20 billion dollars per year.[16] However, volatility within exporting nations can further strain the Department of Defense budget. According to one study, “a $10 change in the per barrel cost of oil translates to a $1.3 billion change to the Pentagon’s energy costs.”[17] Further exacerbating this market are pressures by nations or actors that do not support common U.S. goals and interests.[18] This volatility, real or perceived, creates unpredictable reactions that affect the energy interests of the United States.

Meanwhile, the magnitude of physical security risk associated with energy increases as the United States becomes progressively more dependent upon imported oil. Today, the United States imports approximately 60 percent of its oil requirement. Of these imports, roughly 28 percent comes from member countries of the Organization of Petroleum Exporting Countries (OPEC) and 13 percent of the imports from OPEC are from Persian Gulf countries.[19] The vulnerable nature of oil infrastructure often becomes an opportune target for various actors attempting to advance their interests onto the global stage. Successful attacks provide credibility to these groups by creating political, military, and economic consequences to those who depend upon a steady supply of oil. One example is the effect of decreased Iraqi oil production as a result of war, insurgent attacks, theft, and oil smuggling. In 2007, production capacities were 700,000 barrels less than their pre-2003 levels. Another example is the attempted, but unsuccessful, terrorist attack on a Saudi Arabian facility in 2006 that provides the majority of the

country's production.[20] In reviewing these specific instances and evaluating the outcome of potential future attacks, CNA concluded that "…a series of well coordinated attacks on oil production and distribution facilities could have serious negative consequences on the global economy."[21] Clearly this dependency upon an unstable region of the world represents a continuous risk to the security and prosperity of the United States.

The cost of the nation's addiction also drives foreign policy decisions. In 1980, President Jimmy Carter, during his State of the Union address, articulated what has become known as the Carter Doctrine[22]. He stated,

> "An attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America, and such an assault will be repelled by any means necessary, including military force."[23]

In hindsight, this doctrine committed all elements of U.S. national power to ensuring the free flow of oil to the global market. To mitigate these factors the United States attempts to improve energy security through extensive foreign relations with oil producing nations and numerous domestic measures designed to minimize market volatility. President Carter's statement over thirty years ago led to the current situation as described by Peter Singer, "It is high time we address the long standing irony of fueling our national defense from a source that threatens our nation's security."[24]

Defining the Strategic "End"

Defining specifically what needs to change and creating an environment for change to overcome the nation's oil addiction is a national priority. As articulated by President Obama in the National Security Strategy, "As long as we are dependent on fossil fuels, we need to ensure the security and free flow of global energy resources. But without significant and timely adjustments, our energy dependence will continue to

undermine our security and prosperity."[25] As previously described—economic volatility, vulnerability of supplies, and physical security of oil infrastructure—all directly relate to the greater national security interests of the United States. Frictions within these areas lead to increase competition within the international market and ultimately drive reactive efforts by oil dependent nations. In order to mitigate these issues the United States must develop a proactive approach to the problem. The United States must synchronize all elements of national power to achieve the strategic "end" of developing and implementing increased energy efficiency practices and transitioning to diverse, sustainable alternative energy sources. By articulating this defined strategic "end" the nation can then focus development of the "means" and "ways" to achieve energy security.

Developing the "Means" to Facilitate Change

The development of national policy that incorporates effective and long-term energy security is an extremely complicated affair. Adding to the complexity are the elements of resource allocation and political inertia. Successful policy provides the nation with both an objective and appropriate resources to accomplish that objective. However, un-resourced policy represents a "good idea" without the "means" to achieve the objective. In order to achieve lasting change, the executive and legislative branches of the government must work together to develop and stimulate the changes needed to resolve the nation's oil addiction. Since the legislative branch authorizes and appropriates the "means" or fiscal resources, it must ensure the risk associated with the investment is acceptable. Due to the complexity and magnitude of the nation's oil addiction, there is no single or simple solution to the problem. Thus, the risks associated with the proposed solutions are equally significant and difficult to overcome.

A second element of complexity falls into the broad category of political inertia. Political inertia represents the myriad of factors resisting the proposed policy changes that could reduce the nation's dependency on foreign energy sources. Examples of these factors include a range of issues such as: international and domestic economic performance, foreign policy implications, and environmental impacts from a local to a global scale. Additional factors include foreign and domestic taxation, land and resource management, and research and development policies, and capitalization.[26]

The factors described above create a myriad of special interests and complex challenges for the nation's lawmakers. As previously articulated, there is no simple or single solution for the nation's policymakers to implement into laws that support achieving the strategic "end." Not only is it difficult to develop clear consensus for the nation's energy goals or "ends", allocating the "means" is even more difficult. A very recent example of the inability to establish and implement policy is best exemplified by President Obama's recently published "Blueprint for a Secure Energy Future."[27] This document articulates that America's "addiction" to oil exposes it to numerous risks. Unfortunately, a "blueprint" does not carry the weight of a law, policy, or mandate and therefore only recommends change. The President's approach to this issue makes it difficult, if not impossible for the nation's lawmakers to create the needed legislation and appropriate funding to meet the ideas articulated within the "Blueprint." For these reasons and many more it is no wonder the Council on Foreign Relations concluded that, "…the political system of the United States has so far proved unable to sustain the policies that would be needed to manage the dependence on imported fuels."[28] Ultimately, the nation's failure to develop long-term policies and guidance, better known

as the “ends”, leads to incomplete or poorly focused short-term resourcing solutions best described as the “means.” These short-term or incomplete measures fail to improve energy security because they fail to produce greater energy efficiency practices and the development of sustainable alternative energy sources.

Determining the “Ways”

Although the oil crisis of 1973 was a shocking experience for the United States, it quickly faded once oil markets and fuel prices returned to an acceptable cost for the U.S. consumer. Similar markets shocks have occurred at least four times since and typically generate increased concern regarding energy availability, affordability and policy until the crisis dissipates.[29] As stated by the Council on Foreign Relations, “The foreign policy apparatus resolves energy issues with ad hoc decisions. As the crisis abates, the issues cease to attract attention.”[30] This reactive approach creates enormous risk for a nation that relies upon imported energy to meet approximately 60% of its demand.[31]

In order to reduce the dramatic impacts of global market shocks on the United States economy, leaders must focus on increasing efficiencies and expanding alternative energy sources. Policy development should support an energy security strategy that balances near term increases in energy efficiencies while diversifying long-term energy requirements using several sustainable, alternative energy sources. Although calls for drastic reductions of imported oil often lead to success for political leaders within their constituency, the reality is that the U.S. will be dependent on foreign oil for decades to come.[32] As identified by Peter Johnson in his work discussing this topic, “Acceptance of the necessity of importing some energy resources highlights the intertwined nature of energy security policy and foreign policy.”[33]

In fact, a balanced approach may provide positive advantages for the United States regarding global trade and foreign policy. Investment and development of alternative energy resources through national policy creates access to a lucrative global energy market. In order to develop its competitive ability the United States must commit to, "the large-scale research, development, and deployment of clean energy technologies necessary to lead in the rapidly emerging multibillion dollar global market."[34] The nation's return on this investment is a secure, diverse, stable supply of energy and competitive entry to a global energy market that potentially provides immeasurable economic gains. In contrast to this approach the United States' current economic trend demonstrates a lack of national focus and action towards the alternative energy market. As noted in a CNA study, "In 2009, the clean energy investments in China were more than $34 billion, nearly twice that of the United States."[35]

A Military Solution

To create real, demonstrable change, national leaders should consider utilizing the nation's military as a model for national energy requirements and solutions as it is a microcosm of U.S. society. As described by CNA, "Because of its experience in technology innovation, DoD is in a position to help drive this change—for itself and the nation as a whole."[36] By encouraging the military to develop energy solutions, national-level policymakers can leverage proven options from which they can develop a strategic approach to long-term energy security policies. A study conducted by Christine Parthermore and Dr. John Nagl further reinforces this theme. Published in September 2010, the authors determine that reliance on petroleum energy by the Department of Defense represents a long-term vulnerability. They highlight that 77% of the energy consumed by the Defense Department is petroleum-based.[37] These findings are

comparable to the energy consumed by the nation as a whole. Based upon the results of their research, they propose the Department of Defense develop a thirty-year strategy to diversify its energy requirements and transition away from petroleum-based energy sources. Their conclusion draws upon two key factors—the vulnerability of global petroleum supplies and the Department of Defenses' overwhelming dependence on petroleum based energy. In addition, these factors coincide with the risks identified by President Obama in his National Security Strategy.[38] The study further acknowledges that individual services have initiated numerous and sometimes successful attempts at adopting energy sources other than fossil fuels. However, the thirty-year strategy proposes to the Defense Department leadership a need to guide, synchronize, and lead service initiatives beyond their current 15 to 20 year focus.[39] Although not an impossible task, given current constructs regarding the responsibilities of the service chiefs to man, train and equip their individual services, it will be an extremely challenging initiative to synchronize at the enterprise level of the Defense Department. Numerous other works describing energy security for the nation echo this same strategic theme. In their report regarding energy security CNA proposes that the "…DOD can provide the testing ground and the economies of scale necessary to begin the innovation that could ultimately change the course of the country."[40]

Development of the "ways" or methods to meet this strategic "end" would be a constructive and positive use of the military element of national power. As articulated by Maryann Lawlor in her article regarding alternative energy solutions, "The push for alternatives to crude-oil-based fuels is as much about greenbacks as it is about greenhouse gases. So for the U.S. military, which spends $20 billion on fuel annually,

the benefit of finding viable bio-fuels can mean saving big bucks."[41] In approaching years, fiscally constrained budgets may provide the Department of Defense with the fiscal imperative to capitalize upon alternative energy sources as stable alternatives to current energy sources. To further emphasize the fiscal implications of the cost of energy, "… each and every $10 increase in the cost of a barrel of oil increases the price of DoD operations by $1.3 billion. To put this into context … is equivalent to a loss of almost the entire U.S. Marine Corps procurement budget."[42] Additionally, commercial and private industry should recognize the implications of a $20 billion dollar market for the development of Department of Defense energy solutions.

Enabling the U.S. military to develop and transition to a new energy source would not be without precedent. Over the course of its history, the United States Navy has utilized sail, coal, oil, and nuclear power for its naval fleet.[43] Land forces have evolved their transportation systems from foot and animal, to steam powered rail, to the modern modes of transportation dependent upon oil. The Department of Defenses' evolutionary role in energy-use is the result of technology and energy improvements combined to meet military requirements of its overall war fighting capability. This constant drive to develop new or improved capabilities is an inherent strength of the Department of Defense. In fact, Jerry Warner and Peter Singer observed, "The DoD has a long and successful history of performing this role, leading the way on revolutionary technologies that moved into the civilian sector like GPS, radar, and the internet."[44] It allows the military to maintain an operational and strategic advantage in the execution of its national security role. Leveraging the ability of the military to evolve towards capability-

focused energy solutions provides the nation both viable and secure energy solutions capable of being applied across the entire national energy infrastructure.

Despite the lack of focus and action by the nation's leadership regarding energy security, the military has recognized energy as a strategic vulnerability. To reduce this vulnerability, numerous efforts are currently underway to develop efficiencies and obtain alternative energy solutions. In July 2010 the Department of Defense and Department of Energy entered into a Memorandum of Understanding to, "…strengthen coordination of efforts to enhance national energy security"[45] This Memorandum reinforces efforts already underway and is intended to, "…accelerate the deployment of its technologies and expertise toward the critical economic and energy security needs of the United States…"[46] The ability to undertake these efforts is best summarized by Elisabeth Rosenthal, "…national energy policies require Congressional debates, military leaders can simply order the adoption of renewable energy. And the military has the buying power to create markets and products."[47] These efforts, due to their positive effects on the nation's war fighting capability, will succeed within the military despite potential interference from partisan politics and commercial economic concerns. As stated by the Chairman of the Joint Chiefs of Staff during his keynote address to the Defense Department's first Energy Security Forum, "We can either lead the change or be changed by the leadership of others, I prefer the former."[48] However, energy efficiencies and alternative energy solutions solely applied to meet military requirements does not directly equate to energy security for the nation. National energy security is achievable only if these efforts receive the resources and support to transition them into civilian use and create a foundation for long-term energy security.

Department of the Navy Initiatives

Currently three quarters of the energy required by the U.S. Navy is used to meet operational demands. The majority of that energy is liquid based petroleum.[49] The vulnerability and risk associated with oil is no longer an acceptable risk to the Naval Service as it executes its national security mission. In order to increase war fighting capability by reducing energy dependency and vulnerability, the Department of the Navy and Marine Corps is pursuing an aggressive strategy for both efficiencies and alternatives to meet their energy demands. This effort began with the Secretary of the Navy mandating change and providing specific guidance to his Service Chiefs. In his remarks to the Energy Security Forum in October 2010, Secretary of the Navy, Ray Mabus, focused on his end state: "Energy reform and the new energy future aren't about politics or slogans, it's about protecting the lives of our troops. It's about making our military better and more capable fighters, it's about making our country more secure and more independent."[50] By fulfilling his responsibility to ensure the Department of the Navy and Marine Corps is postured to defend the nation, now and in the future, his message provides the required vision to focus the efforts of his service chiefs. To reinforce this vision, he defined energy security for the naval service as, "…having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet operational needs afloat and ashore."[51] Regardless of the political and economic challenges associated with this dramatic transition, he has focused the Naval Service towards success.

In order to synchronize his vision and intent the Secretary of the Navy developed an aggressive set of strategic goals. These goals incorporate a near-term deadline of

2020 and encompass energy profile changes for both garrison installations and operational capabilities of the Naval Services. In short, he calls for:

- Sail[ing] the "Great Green Fleet": DON will demonstrate a Green Strike Group in local operations by 2012 and sail it by 2016.
- Increase[ing] Alternative Energy Ashore: By 2020, DON will produce at least 50% of shore-based energy requirements from alternative sources; 50% of DON installations will be net-zero.
- Increase[ing] Alternative Energy Use DON-Wide; By 2020, 50% of total DON energy consumption will come from alternative sources.[52]

Additionally, he mandated that alternative energy sources for the Naval Services are "third generation" biofuels. This generation of biofuel does not compete with food sources, has a cleaner carbon footprint than fossil fuel, and has the potential to be cheaper than fossil fuel in the long-term.[53] In order to achieve the combination of these strategic requirements, the Navy and Marine Corps must diversify their energy portfolios and reduce overall reliance upon fossil fuels.

This strategy also aligns with recommendations provided by CNA in their "Powering Americas Defense" study. This study recommends an energy transformation strategy that focuses on two major lines of effort. The first line of effort focuses on identifying and developing energy efficiencies and alternative energy sources for military installations as a model of a small city. The second line of effort is to improve energy efficiency and reduce dependence upon oil for the operational forces.[54] Currently many military installations receive their energy from external sources. By developing methods and sources to make these installations independent from external energy sources or "net zero" consumers, the Department of Defense develops energy profiles and

methods that allow for a transition to civilian application with reasonable chances of success.

Today, efforts at several military installations are achieving various levels of success. One primary reason is that proven methods and processes often meet installation efficiency requirements even across diverse environmental and geographical areas. Examples of several improvements at military facilities include: installing energy efficient appliances, procuring electric vehicles for local transportation, using E-85 fuel for commercial vehicle fleets, and many other near-term projects that enable military installations to progress towards meeting the goals set by the Secretary of the Navy. The Marine Corps effort to develop alternative energy sources to support installations has predominately succeeded on the West coast. This is due to the unique environmental factors associated with both wind and solar power, which have been their most successful methods thus far. Currently the largest wind turbine in the Department of the Navy is located on the Marine Corps' installation in Barstow, California.[55] Through a combination of wind power, solar power, and energy efficiency initiatives, it is projected that Barstow will be one the first "net zero" bases for the Marine Corps as a result of producing as much energy as they consume.[56]

Following the second line of effort, the services achieved several major successes in the pursuit of both energy efficiencies and alternative energy sources required for the operational forces. One of the greatest operational success stories for energy efficiency is the U.S.S. Makin Island. The U.S.S. Makin Island uses a concept similar to that employed in the *Prius*, Toyota's hybrid car. Two auxiliary propulsion motors powered by the ships electric plant are the primary source of propulsion when

traveling at slower speeds. This propulsion system, designed to power the ship up to twelve knots, provides greater efficiencies in both energy usage and overall maintenance. For speeds above twelve knots traditional gas turbine engines are used. Projections for the U.S.S. Makin Island estimate it will spend approximately seventy-five percent of its time underway at twelve knots or less. Based upon this estimate, the U.S.S. Makin Island will save the U.S. Navy approximately $250 million dollars in annual fuel costs over a forty-year lifespan.[57] The U.S.S. Makin Island demonstrated this increased energy efficiency during her transit from the shipyard in Pascagoula, Mississippi to her homeport of San Diego, California. Employing a combination of auxiliary propulsion and traditional gas turbine engines she saved the U.S. Navy over $2 million dollars and 900,000 gallons of fuel when compared to a traditionally powered ship of the same class.[58]

Bio-fuel is another U.S. Navy alternative energy success story. Currently the U.S. Navy's bio-fuel is optimally a 50/50 blend of traditional petroleum based fuel and a bio-fuel derivative—in the case of Camelina it is the oil derived from a seed of the mustard plant family.[59] The research, development, and testing of Camelina based bio-fuel provides encouraging results. On April 22, 2010, Earth Day, the U.S. Navy conducted a test flight, which included supersonic speeds, of an F/A–18 jet fighter utilizing Camelina based bio-fuel. This operational test was the result of extensive research and testing prior to the flight and provides critical information to initiate further testing of this bio-fuel for additional aircraft.[60] In addition, the U.S. Navy also conducted successful experimental tests using an algae-based bio-fuel for surface craft propulsion.[61]

Although successful in the realm of experimentation and testing these fuels are still very expensive. The cost for a gallon of Camelina is approximately seventy dollars per gallon and the cost for algae-based bio-fuel is still several hundred dollars per gallon.[62] When compared to the several dollars per gallon cost for traditional petroleum-based fuel the challenge for the Navy is to focus on a bio-fuel solution that can transition to a commercial market thereby increasing the affordability of the fuel. However, as summarized by Thomas Friedman, "If the Navy really uses its buying power when buying power… it alone could expand the green energy market in a significant way.[63]

The Marine Corps achieved significant contributions to increasing energy efficiency and applying alternative energy successes as well. Focusing predominately on operational requirements, these efforts are succeeding in the combat environment of Afghanistan. In response to the goals set by the Secretary of the Navy, former Commandant of the Marine Corps, General James Conway recognized the Marine Corps and other services face a greater challenge in the austere and expeditionary environments of today's battlefields. To answer this challenge, he identified energy efficiency as the primary near-term goal and addressed energy education and a cultural change for individual Marines as the method for adopting energy efficiency practices.[64] In addition, meeting this challenge requires focused leadership that promotes realistic goals, reinforced through demonstrable successes. The Marine Corps' envisions itself as, "The premier self-sufficient expeditionary force, instilled with a warrior ethos that equates the efficient use of vital resources with increased combat effectiveness."[65]

In December of 2009, the Marine Corps in conjunction with the Office of Naval Research created the Experimental Forward Operating Base (ExFOB) in Quantico,

Virginia. Designed to mimic the energy requirements of a Forward Operating Base, ExFOB would become the venue for commercial vendors to display alternative energy or energy efficient technology and equipment. The initial request for participation received responses from over 100 commercial vendors, many with energy efficiency and alternative power systems available for immediate use. The two organizations then selected several diverse and promising systems for further testing at ExFOB in March 2010. These initial successes of Quantico's ExFOB effort lead to the development of a similar ExFOB in 29 Palms, California. This 29 Palms site allows the Marine Corps to closely mirror energy requirements experienced in Afghanistan, train selected individuals and units to use new systems or technologies, and issue actual deployable equipment sets to selected units deploying to combat.[66]

3rd Battalion, 5th Marines is the first unit to experiment and demonstrate the successes of these efforts in combat. Deployed to Afghanistan, the Marines of 3/5 have utilized the Ground Renewable Energy Networks (GREENS), Solar Portable Alternative Communications Energy Systems (SPACES), LED lighting systems, Solar Shades, and Solar Light Trailers. These systems allowed the Marines to reduce electricity supplied through generators by harnessing solar energy and technology to power lighting systems, computers and recharge batteries for communications equipment. According to Marine Corps officials, the use of GREENS to augment a generator at one site resulted in a 90% reduction in fuel use.[67] For small units operating outside the FOB, batteries recharged by solar systems maintain critical communications links without the burden and danger associated with a daily resupply.[68] The initial combat test for these selected items has been extremely successful. As stated by one Marine using the

equipment, “When we first got the gear, I was a skeptic. Now that we are in theater …it has proven to be an extremely valuable asset.”[69]

Conclusion

The initial successes by both the Navy and Marine Corps are leading the way by adopting energy efficiency practices and developing diverse, renewable, and sustainable alternative energy sources in the Department of Defense. By leveraging both garrison installation and operational force requirements, the Department of the Navy focused its most powerful asset, its people, onto identifying and implementing energy solutions that meet the strategic goals set by the Secretary of the Navy. These initial successes would not be possible without the equipment and technological solutions developed by the commercial market. Continuing this successful relationship will lead to improved products and increased development of the commercial market sector to meet Department of Defense requirements.

To achieve lasting change for these “good ideas” the executive and legislative branches of the government must identify, preferably using military successes, those areas capable of transitioning to national-level implementation. This will require synchronization of policy, law, and investment of the required resources that articulate the “means” for the nation. The magnitude of this effort will challenge the nation’s leadership. However, utilizing successful military efforts as the basis for national solutions and recognizing the economic benefits of a robust alternative energy market obligate the nation’s leadership to overcome this challenge. Secure energy to meet America’s requirements can be achieved by developing a defined set of “means” further supports the “ways” and the overall “end” defined as implementing increased energy efficiency practices and diverse, sustainable alternative energy sources. Failure to

achieve this “end” will continue to expose the nation to a global energy market that poses economic volatility, supply vulnerabilities and physical security risk to the nation’s future prosperity.

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